

1 **WHAT IS CLAIMED IS:**

2 1. A vehicle straightening bench for applying force to vehicle chassis and restoring vehicle
3 chassis to desired configurations, the bench comprising:
4 a vehicle platform including a front, a rear, opposed sides corresponding to a length, a
5 top, and a bottom, the vehicle platform being operable to support a vehicle chassis
6 to be straightened;
7 at least one anchor attachable to the platform and operable to secure the vehicle chassis to
8 the platform;
9 a carriage track mounted on the platform and extending along the length of the platform;
10 a carriage assembly movably received by the carriage track; and
11 a pulling tower mounted on the carriage assembly.

12 2. The bench according to claim 1 wherein the pulling tower is pivotally mounted on the
13 carriage assembly.

14 3. The bench according to claim 2 wherein the carriage assembly includes a tower
15 positioning mechanism engaging a tower arm, extending between the pulling tower and
16 the carriage assembly and mounting the pulling tower to the carriage assembly, the
17 positioning mechanism being operable to hold the pulling tower in a transport position in
18 which the tower arm is substantially perpendicular to the bench.

19 4. The bench according to claim 2 wherein the carriage assembly includes a tower
20 positioning mechanism engaging a tower arm extending between the pulling tower and
21 the carriage assembly and mounting the pulling tower to the carriage assembly, the
22 positioning mechanism including a pawl follower slidably mounted on the tower arm and
23 a notch plate mounted on the carriage assembly and defining a notch for receiving the
24 pawl follower, so that the tower positioning mechanism holds the pulling tower in a
25 transport position in which the tower arm is substantially perpendicular to the bench
26 when the pawl follower is received in the notch.

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1 5. The bench according to claim 4 wherein the positioning mechanism further includes a
2 pawl biasing member engaging the pawl follower and forcing the pawl follower against
3 the notch plate and biasing the pawl follower into the notch.
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5 6. The bench according to claim 5 wherein the carriage assembly includes a carriage body
6 defining a lock pin opening and a locking mechanism comprising a lock pin movably
7 received in the lock pin opening, a lock pin biasing member received in the lock pin
8 opening and engaging the lock pin to bias the lock pin into an extended locking position
9 in which an operator applying force to the pulling tower can overcome the force of the
10 pawl biasing member to pivot the pulling tower relative to the carriage assembly.
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12 7. The bench according to claim 6 wherein the lock pin is coaxial with a pivot axis of the
13 pulling tower.
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15 8. The bench according to claim 1 wherein the carriage track extends along both sides and
16 the front of the platform and includes an inner rail and an outer rail.
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18 9. The bench according to claim 8 wherein the carriage track includes a pair of arcuate
19 corners.
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21 10. The bench according to claim 8 wherein the carriage assembly includes an inner wheel
22 supported adjacent the inner rail and a pair of outer wheels supported on the outer rail.
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24 11. The bench according to claim 10 wherein the outer wheels each include a circumferential
25 ridge engaged in a wheel slot defined by the outer rail.
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27 12. The bench according to claim 10 wherein the carriage assembly further includes a guide
28 forced against the outer rail by a guide spring and a pair of guide rollers positioned
29 adjacent the outer wheels.
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1 13. The bench according to claim 10 wherein the pulling tower is supported above a ground
2 surface solely by the carriage assembly.

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4 14. The bench according to claim 1 wherein the carriage assembly includes a carriage body
5 defining a lock pin opening and a locking mechanism comprising a lock pin movably
6 received in the lock pin opening, a lock pin biasing member received in the lock pin
7 opening and engaging the lock pin to bias the lock pin into an extended locking position.

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9 15. The bench according to claim 14 wherein the platform comprises a bottom deck having
10 the track mounted thereon and defining a plurality of pin lock apertures operable to
11 receive the lock pin.

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13 16. The bench according to claim 14 wherein the locking mechanism further comprises a
14 release handle vertically, movably mounted on the pulling tower and an elongated release
15 cable extending between the release handle and the lock pin whereby downward
16 movement of the release handle overcomes the lock pin biasing member and forces the
17 lock pin to a retracted position inside the lock pin opening of the carriage body.

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19 17. The bench according to claim 14 wherein the lock pin biasing member comprises a
20 compression spring.

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22 18. The bench according to claim 1 wherein the carriage assembly includes a carriage body
23 comprising a generally trapezoidal perimeter having an inwardly facing narrow end.

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25 19. The bench according to claim 1 further comprising a movable crossmember extending
26 between inner sides of opposed legs of the bench, and the crossmember comprising
27 opposite ends slideably engaged with slide tracks formed on the inner walls of the
28 opposed legs and a pair of position locks located at the opposite ends, and the position
29 locks being operable to lock the crossmember in a selected position.

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1 20. The bench according to claim 19 wherein the slide tracks define lock openings and each
2 position lock comprises a pivotally mounted lock rod configured for insertion in the lock
3 openings to hold the crossmember in a desired location.

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5 21. The bench according to claim 20 wherein each position lock comprises a rod biasing
6 member forcing the lock rods into the lock openings.

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8 22. A pulling assembly for use with a vehicle platform of a vehicle straightening bench, the
9 pulling assembly comprising:
10 a mounting assembly operable to mount the pulling assembly on the bench at a desired
11 location;
12 an elongated tower arm having a mounting end attached to the mounting assembly and a
13 distal end opposite the mounting end;
14 a pulling tower attached to the distal end of the tower arm; and
15 a force arm including a substantially fixed end attached to the pulling tower and a free
16 end operable to attach to the vehicle platform at a selected one of a plurality of
17 attachment locations.

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19 23. The pulling assembly according to claim 22 wherein the mounting assembly comprises a
20 movable carriage assembly.

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22 24. The pulling assembly according to claim 22 wherein the pulling tower comprises a
23 telescoping pulling tower.

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25 25. The pulling assembly according to claim 22 wherein the force arm comprises a
26 telescoping force arm.

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28 26. A vehicle straightening bench comprising for applying force to vehicle chassis and
29 restore vehicle chassis to desired configurations, the bench comprising:
30 a vehicle platform including a front, a rear, opposed sides corresponding to a length, a top
31 and a bottom, the vehicle platform being operable to support a vehicle chassis to

1 be straightened, and the vehicle platform defining a plurality of anchoring
2 apertures;
3 at least one anchor attachable to the platform and operable to secure the vehicle chassis to
4 the platform;
5 a carriage track mounted on the platform and extending along the length of the platform;
6 a carriage assembly movably received by the carriage track;
7 an elongated tower arm having a mounting end attached to the carriage assembly and a
8 distal end opposite the mounting end;
9 a pulling tower attached to the distal end of the tower arm; and
10 a force arm including a substantially fixed end attached to the pulling tower and a free
11 end operable to attach to the vehicle platform at a selected one of a plurality of
12 attachment locations.

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14 27. The bench according to claim 26 wherein the free end of the force arm is operable to
15 pivot three dimensionally relative to the pulling tower.

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17 28. The bench according to claim 26 wherein the force arm comprises an adjustable length.

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19 29. The bench according to claim 26 wherein the force arm comprises a pivoting platform
20 lock configured for insertion in the platform anchoring apertures and rotation to lock in
21 the platform anchoring apertures.

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23 30. A vehicle straightening bench comprising for applying force to vehicle chassis and
24 restore vehicle chassis to desired configurations, the bench comprising:
25 a vehicle platform including a front, a rear, opposed sides corresponding to a length, a top
26 and a bottom, the vehicle platform being operable to support a vehicle chassis to
27 be straightened;
28 at least one anchor attachable to the platform and operable to secure the vehicle chassis to
29 the platform;
30 a first hydraulically powered lift engaging the vehicle platform and being operable to
31 raise and lower a portion of the vehicle platform;

1 a second hydraulically powered lift, spaced from the first lift and engaging the vehicle
2 platform and being operable to raise and lower another portion of the vehicle
3 platform;
4 at least one hydraulically powered pulling tower securable to the vehicle platform;
5 a first hydraulic pump in operative fluid communication with the first lift and the pulling
6 tower; and
7 a second hydraulic pump in operative fluid communication with the second lift.

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9 31. The bench according to claim 30 further comprising a hydraulic control circuit including
10 a first lift control valve and a second lift control valve, and being operable to permit
11 actuation of the pulling tower only when the first and second lift control valves are
12 closed.

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14 32. The bench according to claim 31 further comprising a remote control operable to control
15 the hydraulic control circuit.

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17 33. The bench according to claim 31 further comprising a programmable logic controller
18 operable to control the hydraulic control circuit based on operator input to the remote
19 control.

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21 34. The bench according to claim 30 further comprising a hydraulic control circuit operable
22 to actuate the first and second lifts independently and simultaneously.

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24 35. The bench according to claim 30 further comprising a first lift latch having a first latch
25 disengaged position and a first latch engaged position operable to hold the first lift at a
26 desired elevation and a second lift latch having a second latch disengaged position and a
27 second latch engaged position operable to hold the second lift at a desired elevation.

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29 36. The bench according to claim 35 further comprising a pneumatic control circuit including
30 first and second pneumatic cylinders operable to move the first and second lift latches,

respectively, between the first and second engaged positions and the first and second disengaged positions.

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4 37. The bench according to claim 36 further comprising a remote control operable to control
5 the pneumatic control circuit.

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7 38. The bench according to claim 36 further comprising a programmable logic controller
8 operable to control the pneumatic control circuit based on operator input to the remote
9 control.

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